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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/099,691	03/14/2002	Knut S. Grimsrud	ITL.0808US (P14231)	4925

8791 7590 01/20/2004

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EXAMINER

TRUONG, BAO Q

ART UNIT	PAPER NUMBER
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2187

DATE MAILED: 01/20/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/099,691

Applicant(s)

GRIMSRUD ET AL.

Examiner

Bao Q Truong

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 March 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-56 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-16, 18-23, 25-27, 29-45, 47-49, 51-53, 55 and 56 is/are rejected.
- 7) ☒ Claim(s) 17, 24, 28, 46, 50 and 54 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 March 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
- a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

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1. The instant application having Application No. 10/099,691 has a total of 56 claims pending in the application; there are 6 independent claims and 50 dependent claims, all of which are ready for examination by the examiner.

Oath/Declaration

2. The applicant's oath/declaration has been reviewed by the examiner and is found to conform to the requirements prescribed in 37 C.F.R. § 1.63.

Drawings

3. The applicant's drawings submitted are acceptable for examination purposes.

Claim Objections

4. Claims 15-18 recite the limitation "the apparatus" on the first line of each claim. There is insufficient antecedent basis for this limitation in the claims. This limitation should be changed to "the storage system", instead.

5. Claims 50 and 54 are objected to under 37 CFR 1.75(c) as being in improper form because a multiple dependent claim should refer to other claims in the alternative only. See MPEP § 608.01(n). Accordingly, the claims 50 and 54 have not been further treated on the merits.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. Claims 1-5, 10, 19-23, 25-26, 29-31, and 35-43 are rejected under 35 U.S.C. 102(b) as being anticipated by Macon, Jr. et al. (U.S. Patent No. 5,410,653).

Referring to claim 1, Macon discloses an apparatus comprising:

a data requestor which has the ability to specify demand data that it wants and to receive reply data including the demand data and optionally also unspecified prefetch data as a file system coupled to a disk drive, via a suitable device driver, for issuing I/O process specifiers to the disk drive (see figure 1: element 10 and column 4: lines 21-24) and obtain both demand data block and read-ahead (prefetch) data blocks (see Abstract, column 2: lines 17-25, and column 3: lines 25-37);

a communication link (see figure 1: elements 8 and 11); and

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a data source coupled to the data requestor over the communication link and which has the ability to determine which prefetch data to send to the data requestor with the demand data (see figure 1: element 4, Abstract, column 2: lines 17-25, and column 4: lines 24-30).

As to claim 2, Macon further discloses that

the data requestor comprises a driver (see column 4: lines 21-24); and

the data source comprises a storage system (see figure 1: element 4 and column 1: lines 8-12).

As to claim 3, Macon further discloses that the storage system comprises a rotating storage device (see figure 1: element 4 and column 1: lines 8-12).

As to claim 4, Macon further discloses that

the data requestor comprises a data destination buffer as disk cache for storing both demand data block and read-ahead data blocks as a disk cache(see figure 1 and 3: element 7); and

the data source further has the ability to write the prefetch data and the demand data into the data destination buffer (see column 4: lines 24-30), and the ability to provide data identifiers which enable the data requestor to selectively retrieve the demand data from the data destination buffer as providing addresses associated with blocks of data within the disk cache (see column 5: lines 12-16 and column 7: lines 13-16).

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As to claim 5, Macon further discloses that the apparatus comprises a computer as a central processing unit (see figure 1: element 2).

As to claim 10, Macon further discloses that the prefetch data are stored contiguously with the demand data in a storage device of the data source (see figure 2C, Abstract, column 3: lines 33-37, and column 6: lines 59-68).

Referring to claim 19, Macon discloses a storage driver for execution by a data requestor to retrieve demand data from a storage system, the storage driver comprising:

means for identifying the demand data to the storage system as I/O process specifiers issued to the disk drive to read data blocks from specified storage region (see column 4: lines 24-30);

means for receiving reply data from the storage system, in which the reply data includes the demand data and potentially also prefetch data which was not identified by the storage driver as disk cache to receive both demand data block and read-ahead data blocks (see figures 1 and 3: element 7); and

means for selectively retrieving the demand data out of the reply data as providing addresses associated with blocks of data within the disk cache (see column 5: lines 12-16 and column 7: lines 13-16).

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As to claim 20, Macon further discloses:

means for selectively retrieving the prefetch data out of the reply data as providing addresses associated with blocks of data within the disk cache (see column 5: lines 12-16 and column 7: lines 13-16); and

means for caching the prefetch data as the disk cache (see figure 1 and 3: element 7 and column 6: lines 20-24).

As to claim 21, Macon further discloses means for receiving an offset into the reply data at which the demand data is located (see column 6: lines 24-26).

As to claim 22, Macon further discloses means for receiving an indication of how much reply data has been received from the storage system as the content of the Length Counter indicating the amount of read-ahead data blocks to be returned with the demand data block (see figure 3: element 16, column 6: lines 59-68).

As to claim 23, Macon further discloses that the storage system comprises a disk drive (see figure 1: element 4 and column 1: lines 8-12) and the storage driver comprises disk drive driver software executable by a microprocessor of a computer system which is connected to the disk drive (see column 4: lines 21-24).

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Referring to claim 25, Macon teaches a method comprising:

a driver requesting specified demand data from a storage system as issuing I/O process specifiers to the disk drive (see figure 1: element 10 and column 4: lines 21-24);

the storage system determining which prefetch data to include with the demand data (see figure 1: element 4, Abstract, column 2: lines 17-25, and column 4: lines 24-30); and

the driver receiving, from the storage system, the demand data and the prefetch data as obtaining both demand data block and read-ahead (prefetch) data blocks (see Abstract, column 2: lines 17-25, and column 3: lines 25-37).

As to claim 26, Macon further teaches the storage system determining which prefetch data to include, based at least in part on a state of tile storage system as the state whether the read-ahead data blocks are consecutive with the demand data block (see figure 2C and column 6: lines 59-68).

As to claim 29, Macon further teaches the driver receiving from the storage system information identifying where, within reply data that includes the demand data and the prefetch data, the demand data is located (see column 6: lines 24-26).

As to claim 30, Macon further teaches the storage system providing, in the information, a demand data offset and a reply length as the content of the Length Counter indicating the amount of read-ahead data blocks to be returned with the demand data block (see figure 3: element 16, column 6: lines 24-26, and column 6: lines 59-68).

As to claim 31, Macon further teaches that the driver and the storage system are connected by communication link (see figure 1: elements 8 and 11).

Referring to claim 35, Macon teaches a method of operating a storage device driver in a processor-based system which includes a storage system, the method comprising:

receiving a first request for demand data and receiving a demand address for demand data block (see figure 6: block A and column 5: lines 57-59);

sending a second request for the demand data to the storage system as issuing I/O process to read demand data block (see figure 6: blocks N and G, and column 6: lines 59-68);

receiving reply data from the storage system as receiving both demand data block and read-ahead data blocks at disk cache (see figure 2C and column 6: lines 59-68);

receiving identifying data from the storage system as providing addresses associated with blocks of data within the disk cache (see column 5: lines 12-16 and column 7: lines 13-16).; and

using the identifying data to selectively retrieve the demand data from the reply data as using addresses associated with block of data within the disk cache to return demand data to requestor (see column 5: lines 12-16 and column 7: lines 13-16).

As to claim 36, Macon further teaches using an offset indicator in the identifying data to identify a beginning location of the demand data in a buffer in which the reply data were received (see column 6: lines 24-26).

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As to claim 37, Macon further teaches using a reply length indicator in the identifying data to determine how much prefetch data were received from the storage system in the reply data with the demand data as the content of the Length Counter indicating the amount of read-ahead data blocks to be returned with the demand data block (see figure 3: element 16, column 6: lines 59-68).

As to claim 38, Macon further teaches caching the prefetch data as storing read-ahead data blocks in disk cache (see figure 1 and 3: element 7 and column 6: lines 20-24).

As to claim 39, Macon further teaches that the reply data comprises prefetch data and the demand data as obtaining both demand data block and read-ahead (prefetch) data blocks (see Abstract, column 2: lines 17-25, and column 3: lines 25-37).

As to claim 40, Macon further teaches that the demand data and the prefetch data are from contiguous areas of storage (see figure 2C, Abstract, column 3: lines 33-37, and column 6: lines 59-68).

As to claim 41, Macon further teaches that the demand data and the prefetch data are from discontinuous areas of storage (see figure 2C, Abstract, column 3: lines 37-45, column 6: line 68, and column 7: lines 1-5).

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Referring to claim 42, Macon teaches a method of operating a storage system in conjunction with a data requestor which does not specify how much prefetch data the storage system should return with demand data requested by the data requestor, the method comprising:

sending the demand data to the data requestor (see figure 6: block N);

determining what prefetch data to include with the demand data as anticipating, in a file system, a sequential data access and determining which data blocks to be prefetch (see figure 1: element 4, Abstract, column 2: lines 17-25, and column 4: lines 24-30).;

sending the prefetch data to the data requestor (see figure 6: block G); and

providing identifying data to enable the data requestor to discern the demand data from the prefetch data as providing addresses associated with blocks of data within the disk cache (see column 5: lines 12-16 and column 7: lines 13-16).

As to claim 43, Macon further teaches the determining what prefetch data to include comprises basing the determination at least in part on a state of the storage system as the state whether the read-ahead data blocks are consecutive with the demand data block (see figure 2C and column 6: lines 59-68).

As to claim 49 and 51-52, Macon teaches the method of claim 35 in a computer environment. Inherently, the method of claim 35 can be implemented as instructions stored on a machine-accessible medium comprising a recordable storage medium, a carrier wave.

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As to claim 53 and 55-56, Macon teaches the method of claim 42 in a computer environment. Inherently, the method of claim 35 can be implemented as instructions stored on a machine-accessible medium comprising a recordable storage medium, a carrier wave.

8. Claims 12-14, 16, and 18 are rejected under 35 U.S.C. 102(e) as being anticipated by Bates, Jr. et al. (U.S. Patent No. 6,633,957 B2).

Referring to claim 12, Bates discloses a storage system for responding to a demand data request from a data requestor, the storage system comprising:

- a controller for performing logic operations of the storage system (see figure 1: element 10);

- a storage drive coupled to the controller (see figure 1: element 18);

- a storage cache coupled to the controller (see figure 1: element 24); and

- at least one prefetch algorithm executable by the controller to determine, which prefetch data to include with demand data in a response to the demand data request, and to retrieve the prefetch data and the demand data from at least one of the storage drive and the storage cache, and to provide to the data requestor reply data including the prefetch data and the demand data (see figures 2A-B, 3; column 5: lines 26-67; and column 6: lines 1-20).

As to claim 13, Bates further discloses that

the storage device comprises a rotating storage device (see figure 1: element 18 and column 2: lines 41-44); and

the at least one prefetch algorithm includes the ability to utilize a rotation state of the rotating storage device in determining which prefetch data to include with the demand data in the response as utilizing the state whether the prefetch data blocks are consecutive with the demand data block (see figure 2A-B: event E2 and column 3: lines 27-33).

As to claim 14, Bates further discloses that

the rotation state includes whether the prefetch data will arrive at a read head of the rotating storage device after the demand data (see figure 2A-B: event E2 and column 3: lines 27-33).

As to claim 16, Bates further discloses that the prefetch data are contiguous with the demand data on the storage device (see figure 2A-B: event E2 and column 3: lines 27-33).

As to claim 18, Bates further discloses that the reply data further include information enabling the data requestor to select the demand data from the reply data as being able to detect whether all of the blocks in the host request are available in cache (see column 5: lines 59-64).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 6-9 and 32-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Macon, Jr. et al. (U.S. Patent No. 5,410,653) in view of Okayasu (U.S. Patent No. 6,449,696 B2).

As to claims 6-9, Macon discloses the apparatus of claim 1 above. However, Macon does not clearly disclose that the communication link comprises a local area network as in claim 6, a wide area network as in claim 7, the Internet as in claim 8, a host disk controller as in claim 9.

Okayasu discloses an apparatus similar to that of Macon (see Abstract and Summary of The Invention). Okayasu further discloses that the communication link, over which the data source coupled to the data requestor, comprises a local area network (see figure 1: element 4 and column 7: lines 27-38), a wide area network (see figure 1: elements 7-8 and column 7: lines 27-38), the Internet (see figure 1: element 6 and column 7: lines 27-38), a host disk controller (see figure 2: element 16 and column 7: lines 39-46).

It would have been obvious to one having an ordinary level of skill in the art at the time the invention was made to modify the apparatus disclosed by Macon so that the communication link comprises a local area network, a wide area network, the Internet, a host disk controller.

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This would have been obvious because Macon clearly teaches that prefetching is known as disk access avoidance technique that obtains a set of data blocks in a high-speed cache memory with the expectation that some or all of these blocks will subsequently be requested (see column 1: lines 14-19 of Macon). Therefore, prefetching is useful not only locally on a single PC - disk drive system, where a host disk controller is implemented as a communication link, but also across local area network or extended network (see figure 1 of Okayasu).

As to claims 32-34, Macon teaches the method of claim 31 above. Macon further teaches that the method is performed by a computer system, the driver is executed by a microprocessor of the computer system, and the storage system comprises a disk drive system of the computer system (see figures 1 and 3, and column 4: lines 9-30). However, Macon does not clearly disclose that the communication link comprises the Internet as in claim 32, a local area network as in claim 33, and a host disk controller interface to the storage system and in claim 34.

Okayasu teaches a method similar to that of Macon (see Abstract and Summary of The Invention). Okayasu further teaches that the communication link, over which the data source coupled to the data requestor, comprises the Internet (see figure 1: element 6 and column 7: lines 27-38), a local area network (see figure 1: element 4 and column 7: lines 27-38), and a host disk controller (see figure 2: element 16 and column 7: lines 39-46).

It would have been obvious to one having an ordinary level of skill in the art at the time the invention was made to modify the method taught by Macon so that the communication link comprises the Internet, a local area network. This would have been obvious because Macon clearly teaches that prefetching is known as disk access avoidance technique that obtains a set of

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data blocks in a high-speed cache memory with the expectation that some or all of these blocks will subsequently be requested (see column 1: lines 14-19 of Macon). Therefore, prefetching is useful not only locally on a single PC - disk drive system, where a host disk controller is implemented as a communication link, but also across local area network or extended network (see figure 1 of Okayasu).

11. Claims 11, 27, 44-45, and 47-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Macon, Jr. et al. (U.S. Patent No. 5,410,653).

As to claim 11, Macon discloses the apparatus of claim 1 above. However, Macon does not clearly disclose that the data requestor specifies null demand data.

It would have been obvious to one having an ordinary level of skill in the art at the time the invention was made to include, in the apparatus disclosed by Macon, the case when the data requestor specifies null demand data. This would have been obvious because Macon clearly teaches that prefetching is known as disk access avoidance technique that obtains a set of data blocks in a high-speed cache memory with the expectation that some or all of these blocks will subsequently be requested (see column 1: lines 14-19). Therefore, prefetching is effectively used not only when the host requests for data but also when the host does not request for data.

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As to claim 27, Macon teaches the method of claim 26 above. However, Macon does not clearly teach that the state of the storage system comprises whether the prefetch data is already in a storage cache in the storage system.

It would have been obvious to one having an ordinary level of skill in the art at the time the invention was made to configure the method taught by Macon such that the state of the storage system comprises whether the prefetch data is already in a storage cache in the storage system. This would have been obvious because Macon clearly teaches that prefetching is known as disk access avoidance technique that obtains a set of data blocks in a high-speed cache memory with the expectation that some or all of these blocks will subsequently be requested (see column 1: lines 14-19). Therefore, determining which data blocks to be prefetched should be based on whether the data blocks are already in the storage cache in the storage system.

As to claim 44, Macon teaches the method of claim 43 above. However, Macon does not clearly teach that the state of the storage system comprises whether the prefetch data are cached.

It would have been obvious to one having an ordinary level of skill in the art at the time the invention was made to configure the method taught by Macon such that the state of the storage system comprises whether the prefetch data are cached. This would have been obvious because Macon clearly teaches that prefetching is known as disk access avoidance technique that obtains a set of data blocks in a high-speed cache memory with the expectation that some or all of these blocks will subsequently be requested (see column 1: lines 14-19). Therefore, determining which data blocks to be prefetched should be based on whether the data blocks are already cached.

As to claim 45, Macon further teaches that the state comprises whether the demand data are cached as returning the demand data block to the requestor, without any prefetching, if it is already cached (see figure 6: block A-D, F, and O).

As to claim 47, Macon further teaches that the state comprises whether the prefetch data can be efficiently retrieved following the demand data as whether the demand data and the prefetch data are from contiguous areas of storage (see figure 2C, Abstract, column 3: lines 33-37, and column 6: lines 59-68).

As to claim 48, Macon further teaches that the state comprises whether the prefetch data will cause a head seek as the demand data and the prefetch data are from contiguous areas of storage (see figure 2C, Abstract, column 3: lines 33-37, and column 6: lines 59-68).

12. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bates, Jr. et al. (U.S. Patent No. 6,633,957 B2).

As to claim 15, Bates discloses the storage system of claim 12 above. However, Bates does not clearly disclose that the data requestor specifies null demand data.

It would have been obvious to one having an ordinary level of skill in the art at the time the invention was made to include, in the system disclosed by Bates, the case when the data requestor specifies null demand data. This would have been obvious because Bates teaches that prefetching and loading records from a large volume storage disk drive into a cache memory,

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prior to a request for the records, will enhance the performance of the system (see column 1: lines 29-36). Therefore, prefetching is effectively used not only when the host requests for data but also when the host does not request for data.

Allowable Subject Matter

13. Claim 17 is objected to as lacking antecedent basis for one limitation in the claim and as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form overcoming the claim objection and including all of the limitations of the base claim and any intervening claims.

14. Claims 24, 28, and 46 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

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Conclusion

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. See Form PTO-892.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bao Q Truong whose telephone number is (703) 308-7090. The examiner can normally be reached on Monday-Friday from 8:30 AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Donald A Sparks, can be reached on (703) 308-1756. The fax phone number for the organization where this application or proceeding is assigned is (703) 746-7239.

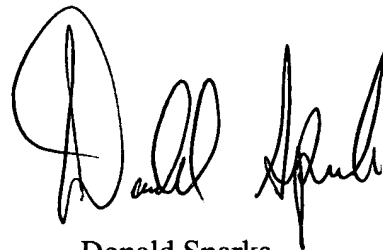
Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.

Bao Q Truong

BT

Patent Examiner

January 12, 2004



Donald Sparks

Supervisory Patent Examiner

Technology Center 2100